



rely on his representations, which, so far as regards the feasibility of the undertaking, have received the unqualified approval of the professional member of the Board of Public Works, Lieutenant-Colonel Lawe, the Chief Engineer, who has recorded a separate minute on the plan; and with respect to the high importance of the work, the Board of Revenue and the Collector entirely concur in opinion.

"We accordingly comply with your strong recommendation in favour of the project and sanction the proposed expenditure of £47,575 for carrying it into execution."

Busy scenes followed on the shores of the noble river. At one time over five thousand workmen were employed. But the great Engineer was seriously delayed and hindered for want of competent artisans. In one report he states:—"We have been much delayed from want of artificers in metals which has kept us back in the preparation of wagons and other apparatus."

As an indication of the considerable and varied establishment he had to call into being, the following paragraphs are of interest:—

"The quarry has been greatly extended, and railways carried through most part of it, though the length of the rock laid open is still rather too confined for the number of stone-cutters employed. But, having now four cranes and about sixteen wagons at work, the further opening of the quarry will proceed rapidly. One double railway is completed from the quarry to the river, and has been in use for some time. The wagons run the whole way of themselves, the road having a good slope. At present they are discharged on the side of the road, and the stones carried into the boats, which come up close to the end of the rails, but a wharf will soon be completed to enable all the small stones to be discharged into the boats at once. The other double railway is now within a short distance of the river, and materials for it are carried from the quarries by the wagons. Eighteen boats have been launched, and they answer very well. They are chiefly



employed in carrying stone across the river, and it is at present deposited near the sites of the head sluices and locks, for which it will be first wanted. About one hundred and fifty tons a day are carried by water at present. On both lines of railway about four hundred tons a day of stones and gravel are conveyed, and this quantity will rapidly increase. At least fifty thousand tons of rough stone have been quarried and thrown in heaps near the railways in the quarry, and about eight thousand tons have been conveyed to the line of the anicut. Cut stone to the extent of twenty-five thousand cubic yards has been prepared. Two kilns have been kept burning for about two months, yielding now about two hundred parabs¹ of chunam a day each, and about four hundred garce¹ are now in store. The cutting and embanking for the railway from the limestone quarry to the river has been nearly completed, and a considerable part of the rails laid. It is two miles in length."

He continues:—

"At one time, when the first fresh was rising, some alarm was caused by the current cutting away the narrow point of land that divides the head of the channel on the Dowlaisweram side from the river, but it was protected by some stones and no harm was done.

"The new embankments between the wing-walls of the anicut, across Rallee and Muddoor islands, have stood excellently, having suffered neither from the rains nor the freshes. The water during the freshes flowed down the new cutting made on the Vijaisweram side for the head of the main channel, and this has thus been of considerable use this year. The cutting in Rallee head has not been carried far enough to communicate with any of the old channels.

"We are thus in a very fair position for commencing the operations of the season as early as the rains and freshes have permitted, and I hope very soon to be depositing one thousand tons of rough stone a day in the line of the work. We shall also shortly commence upon

¹ Indian measures.



the head sluices and locks. We have had from two thousand five hundred to three thousand five hundred people at work during the monsoon, and they have already begun to come in again in considerable numbers. I have every reason to believe they will come in greater numbers than we can employ, unless we undertake a large quantity of earthwork this year; for we shall not require above five thousand people at the anicut, now that we have got the principal railways in operation, and all the preparatory works executed.

"With respect to the progress of the work, I have great reason to be satisfied."

The strain upon a constitution by no means robust was too severe, how severe will be seen in the concluding portion of this chapter where Lady Cotton gives her reminiscences of that period. A breakdown in health occurred and sick leave to Australia was granted.

He himself refers to his ailing health, and expresses his sorrow at not being able to devote the time and attention he wished to what was going on. "It has been some additional hindrance to the progress of the works," he remarks, "that for the last six weeks, in the very height of the working season, I have been so completely broken in health as to be wholly unable to attend to the works personally, and to be only occasionally, even within doors, able to attend to business; and this must needs be the case in a measure, notwithstanding that the other officers are so remarkably effective. The loss of even an inexperienced officer would have been seriously felt."

To his brother Fred, he poured out his troubles thus:—

"I dare not think of the arrears of writing I am in to you, to the Board, and to everybody. I was overwhelmed with the outdoor work of the anicut, when I got a slight stroke of the sun, which, strange to say, I did not at first suppose it was, and applied no local remedy, but that of a little more sun, till I found myself quite floored, with a total inability to take food.



"The first attack was nothing, and had I poured a little cold water on the spot affected, it would have prevented any ill effect. As it was, local applications removed all the symptoms of headache and giddiness in a fortnight; but the mischief having in the meantime extended to the stomach, I was reduced as low as I almost ever was, and have been so completely shaken that I cannot walk a few hundred yards without feeling symptoms of illness of all sorts and kinds. I dare not visit any part of the works, *where I am wanted*, and it is only at times that I can attend to business indoors. There is every symptom of a complete break up, such as nothing but a continual residence in a temperate climate offers any hope of repairing in any degree. This is the very height of our operations, with the works in a most critical state, the freshes close at hand, and the monsoon already set in unusually early; so I am placed in very trying circumstances. I do not know how to leave the works to the responsibility of another man, in such a difficulty, and yet I am utterly unable to do the duties required of a chief engineer.

"We have had innumerable difficulties, and our expenditure this season has been serious, for I was obliged to push on the works, through thick and thin, to get them, if possible, into a state in which the monsoon would do them no serious harm; but, after all, they are far from being in a satisfactory condition.

"We have got one division of the anicut, across the widest channel (nearly a mile), finished off at a level three feet below that intended, and its lock, head sluices and under sluice very nearly ready for the freshes, all such giants compared with the southern works, having to provide for a depth of water of thirty feet, the head sluice with a waterway of twenty-six yards breadth, and the lock, one hundred feet by fifteen.

"A second channel has a similar anicut, well advanced, but the chunam will be so soft when the water goes over it, that it is very doubtful whether it will not be breached. The other sluices and one lock and all the



"MOST PROMISING YOUNG ENGINEER" 119

wing walls are in such a state that I hope they will take no harm.

"But the two remaining channels across which I hope to have established good, strong, rough-stone dams, will, I fear, now be left entirely open, for there is hardly a possibility of our completing the dams sufficiently to prevent their breaching. Owing to the peculiar circumstances of the site, there does not seem reason to fear much mischief if these two channels are left open.

"I have been obliged to send in an additional estimate of £10,000 to complete the work, but, besides all the apparatus and buildings, railroads, boats, steamers, etc., that we have need of, there is about £5,000 worth of material and apparatus that has not yet arrived, or not been sent.

"You have no idea of the work of having to deal with a river of four miles broad on a straight line, and seven miles going round the heads of the lunkas (islands) that divide the channels, and this reduced from seventeen by a channel we cut for half a mile, where, if the water does not admit of a boat bringing the stone, etc., to the very spot, the probability is that there are one or two miles of heavy sand between the work and the material. Our people are not to be named with Malabarians, in any respect whatever; they are in general the poorest creatures possible, both as respects energy and skill, and the veriest slaves in the world.

"On the other hand, I have the most excellent set of officers—four of them—the hardest working fellows I ever saw. Young Haig, I think, is the most promising young engineer I have known. We have also some very good non-commissioned officers.

"I began this several days ago—I have been rather gaining strength since then; our monsoon has set in fully, but not violently, yet it has lowered the thermometer, which I think has had a good effect upon me. But I must soon make way for somebody who has life enough left in him to do the work. Orr is most competent to take up my engineering duties when I leave them.



"The matter is God's—not mine; and if He has a purpose of blessing the district, He will find instruments for His purpose. What the district seems to want above all is a Collector who would give himself up to promote its welfare, and who knows how to do it."

During his absence in Australia, Captain Orr, a trusted and valued Assistant, took Major Cotton's place at Dowlaishwaram. A Committee was also appointed to investigate the works that had been carried out, and others that were still in progress. Those who had not before inspected the scene of his labours were struck with astonishment at the extraordinary progress of the works since their commencement about June, 1847, when some wells were sunk; after which nothing further could be done till after the subsidence of the freshes in October. In March, 1848 only four hundred yards of the rubble masonry forming the body of the anicut had been completed, and in the middle of June the work was again stopped by a very early rise of the river. Yet, when the Committee assembled about November, 1848, they found the first division of the anicut, one thousand four hundred yards in length, completed to the height of nine feet, and the third division, five hundred and twenty yards in length, also to a great extent finished.

Captain Orr, who had imbibed his chief's ardour and interest in the task, laboured most devotedly in carrying out the plans laid down. The construction of the anicut was as fruitful an occasion for anxiety as all such enterprises are. On one occasion Captain Orr had an example of the way in which, in engineering projects as in most else, it is the unexpected which happens. He had just reported he could "make all safe before the freshes set in," when he had to supplement his optimistic remark with the following story of disaster:—

"I have the painful duty to report the occurrence, yesterday afternoon, of very serious damage to that portion of the anicut which I have reported as all



but completed across the Vijaisweram branch of the river.

"The front retaining wall was built quite across; only a small opening at one point, one foot square, being left near its base for the purpose of draining off the water, which oozed through the main temporary dam, and through a semi-circular embankment thrown round the opening, as an additional protection. The latter embankment was made practically of clay, was rivetted on both sides with grass rollers, and being so strong, and the same height as the anicut, was considered by me quite sufficient protection, even in the event of the main dam giving way. Things were in this perfectly satisfactory state, and the final closing of the opening was only delayed, that the adjoining masonry, being new, should have a few days to set before being subjected to the action of water. The river some days ago rose, in forty-eight hours, five inches, in addition to a similar rise which took place about a week before, but since Monday evening it seemed so steady that I was in hopes that the threatened danger of a fresh had passed. Yesterday afternoon, however, the river rose again suddenly, and at about 4 p.m. a very severe squall of wind broke over the works, blowing right down the river, which, piling up the pent up waters against the dams, caused them to breach. Being prepared for such an occasion, I still expected no injury to follow, but, unfortunately, we had not guarded against the unlooked-for, and at this season the unprecedented, contingency of a fresh accompanied by a gale causing such a rise of the river as eighteen inches in an hour, and that, too, while the river was passing freely over the whole length of the Rallee dam, and flowing two and a half feet deep through the Dowlaisweram under sluices. The consequence, I regret to say, was that the small semi-circular dam being topped by the waves, and soon breaching, brought such a pressure of water against the new and unbacked retaining wall that it gave way, and before the extension of the damage could be arrested, about twenty-two yards of the anicut on each



side of the opening were washed away, and a breach some forty-four yards in width formed in the centre of the work. This untimely fresh, however, soon subsided, and before the regular season for floods the damage done was repaired."

To Captain Orr, in one of his reports, Major Cotton paid the following tribute :—

"I cannot conclude without noticing the invaluable aid derived from having an officer of Captain Orr's standing and ability to consult with in operations of this kind. The attention he has paid to railway works in England has also rendered him peculiarly useful here ; but there is not a question connected with the whole management of the delta in which I do not find it of incalculable advantage to have him to consult with upon it. All the officers take the greatest interest in the work, and give me great satisfaction."

Imagine the forces which, in India, hydraulic engineers have to contend with ! Here is a river four miles wide in which the water rises eighteen inches in an hour ! The marvel is that, in presence of such difficulties, the accidents were not many and serious. So thorough, however, were his preparations for the enterprises he undertook that the casualties were very few indeed. But—

"Be the day short, or be the day long,
At length it cometh to evensong."

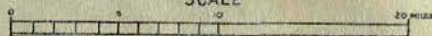
And, with Arthur Cotton's conceptions, despite difficulties, the end, the triumphant end, came without any excessive delay, nay, on the contrary, with unlooked-for expedition. Here is his gratifying statement as to the completion of the anicut and the beginning of channels of watering and navigation which his genius gave to the erstwhile distressed district. The map facing this page will show how the hand of Arthur Cotton is heavily scored on the soil of the district in ineffaceable lines, every line a source of salvation to past, present, and future generations of Indian cultivators.



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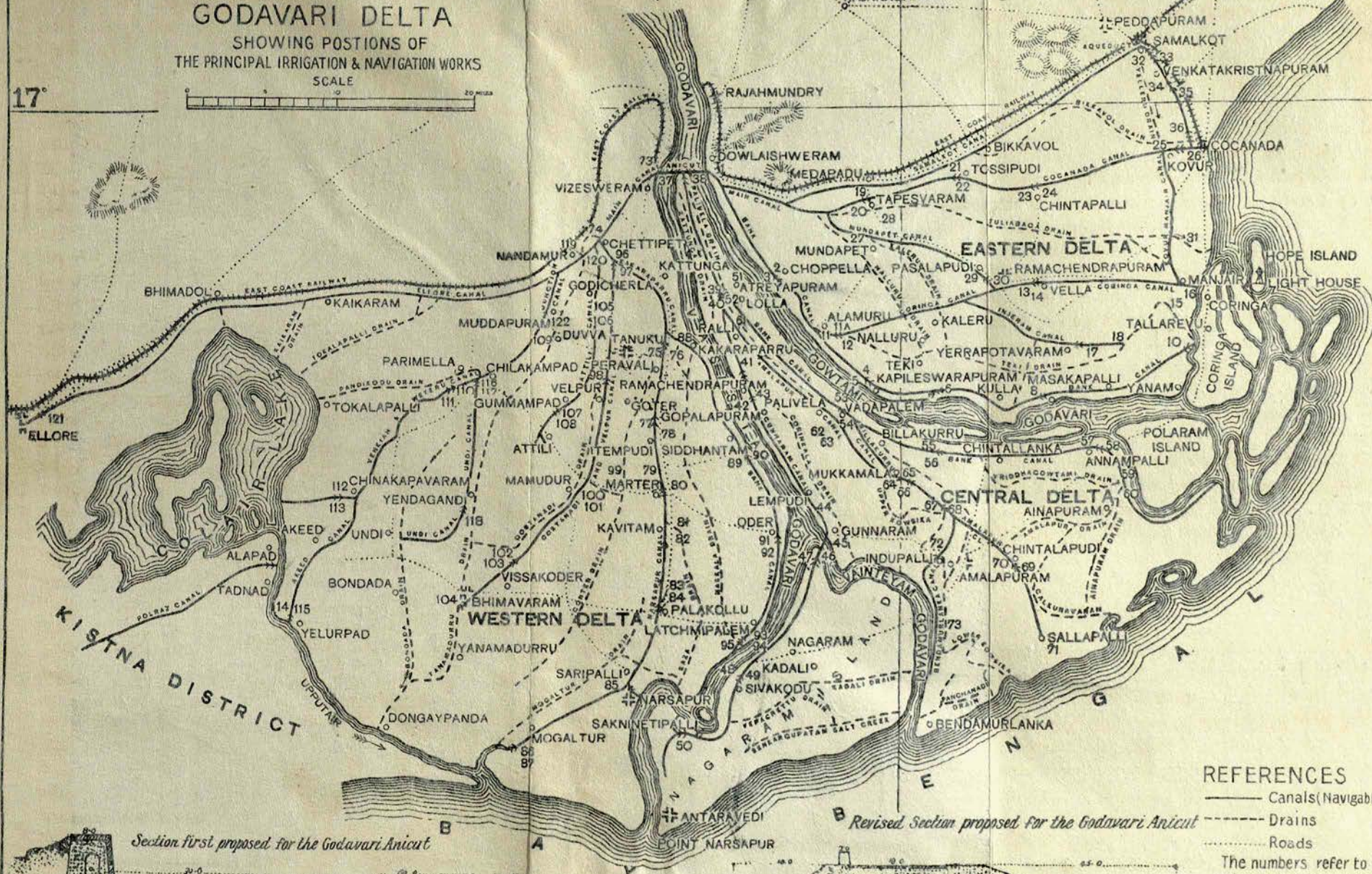
SKETCH MAP
OF THE
GODAVARI DELTA
SHOWING POSITIONS OF
THE PRINCIPAL IRRIGATION & NAVIGATION WORKS

17°



82°

17°



- REFERENCES
- Canals (Navigable)
 - Drains
 - Roads
- The numbers refer to the Principal Masonry Works



Section first proposed for the Godavari Anicut



Revised Section proposed for the Godavari Anicut



RESULTS OF SEARCHING EXAMINATION 123

In April, 1852, he had the happiness to be in the position to send the following report to the Board of Revenue at Madras :—

“I have the honour to report for the information of the Board the following results of an examination of the anicut lately made by Captains Orr and Hutchinson and myself :—

“Commencing from the Dowlaisweram side—

“First. The lock is in perfect order; no expense has been incurred on this work from the first (five years). I cannot help here mentioning the excellent workmanship of the lock gates, as I think they reflect much credit on Captain Hutchinson.

“Second. Head sluice also in good order, and without repairs from the first.

“Third. Under sluices, the same, with the exception that we have had to throw in a prodigious quantity of rough stone for the apron. It has repeatedly sunk one or two yards, and must now contain an enormous quantity of stone. It seems, however, now to be nearly settled, as it has sunk very little of late.

“Throughout the whole work not a rupee is required to repair damage sustained by the work last year. Only a quantity of stone had to be thrown into the apron of the Vijaisweram under sluice during the monsoon. This state of things is to me highly satisfactory. It seems to give a fair prospect of the actual cost of keeping the work itself in order being very insignificant. The alterations and additions proposed this year are all such as would not occur again; and they only amount to three and a half per cent. upon the total cost of the work. There is certainly every prospect that, including every alteration and improvement that can be thought of hereafter, the permanent annual expenditure on it will not be two per cent. upon the cost. One part of the work has now stood four monsoons, and, in one of them, an unprecedented flood. I think we may thus consider the anicut as fairly established. It is also to be considered, that a work like this is



not like a bridge or a building, which is liable to be utterly destroyed. Almost the worst that could happen to it would be a breach of fifty or hundred yards, which could be repaired for £1,000 or £2,000, a trifle in comparison with the first cost. It is also observable that no alteration has been made in the original section of the work, excepting that the rough stone apron has been enlarged. The Dowlaisweram branch is just as originally planned, and no alteration of any consequence has been made in the others. I must, however, say, that here, as in the Coleroon, I would now prefer building a work with a vertical fall, as safer in a sandy river; and so I would in any place excepting one similar to the Kistna, where there is an unlimited supply of stone at very low rates, and where, consequently, twenty cubic yards of rough-stone could be obtained at the same cost as one of cut-stone. When I planned the Coleroon anicut, I considered that the great point in these rivers was to break the force of the water effectually, and prevent it scouring the lower channel; and what I have here seen makes me think still more of the importance of that principle. But I believe, where stone can be obtained very cheaply, a large mass of rough-stone, with a very long slope on the lower side, will be the cheapest and safest work in a sandy river.

"Can we see this large and important work, calculated so substantially to promote the real comfort of a million of people, thus brought to completion through so many difficulties and contingencies, without heartily acknowledging the goodness of God in thus prospering us and bringing the project so far to a successful issue, notwithstanding the opposition it has experienced from quarters from which I had every right and every reason to hope for, and from which I did confidently expect, most cordial and energetic support in carrying out a work of such unequalled magnitude in India (excepting that now on hand in the North-West), a work approved and ordered by the Home authorities, and calculated to be in every way so vast a public benefit? May we not hope that its accomplishment, with the abundant effects



ACKNOWLEDGING THE GOODNESS OF GOD 125

which have already resulted from it to the district, will lead to the adoption of such extensive works for the improvement of the country, and the promotion of the welfare of the people entrusted to our care, as will lead to an increasing appreciation of a Christian Government? There is nothing that the people more thoroughly appreciate, after peace, than public works, and especially those that furnish them with water. And I cannot but trust that this is only the beginning of a series of works worthy of our nation, our knowledge, our religion, and the extraordinary power God has been pleased to put into our hands. I say our religion, because I am sure it ought to lead us to do our utmost in every way to care for those who are thus committed to us.

"It remains for me to speak of the state of the bed of the river about the anicut, which will require to be carefully watched. . . .

"The rough-stone apron of the anicut throughout seems to be well established; there is no appearance of any sinking or disturbance of any consequence this year in any part. It is generally from fifteen to twenty yards broad. I am now, however, throwing in additional stone, according to this year's ordinary estimate, strengthening each branch according to the proportionate force of the water over it. To the Muddoor branch, as it is now higher than it has been hitherto, I propose adding considerably, and also to the Vijaisweram branch, which ought to have an abundantly large apron. The apron laid by Captain Orr last year stood most perfectly; but we can hardly take too much precaution on this point, especially as the cost of rough-stone is so moderate.

"I have now the honour to request that the establishment which I have recommended for the conservation of this important work may, if approved, be appointed without loss of time. A body of thoroughly trained men, under efficient superintendence, permanently resident on each portion of the work is essential, and should be immediately appointed, and housed, that they may be fully



prepared for their duties before the freshes. No water works of any kind can ever be trusted to take care of themselves ; but especially those in a delta require the most vigilant care ; and both the cost of this work, and the vast amount of property dependent upon it, demand that no risk should be run about it. I trust that, whatever is decided as to precise arrangement of the superintendence of this system of works, authority may be granted for entertaining at once those that are required for the anicut and other works already executed, as a temporary arrangement."

The order of the Government on receipt of the above was in cordial and appreciative terms:—

"The Right Honorable the Governor in Council has received with much satisfaction the report of Colonel Cotton on the state of the Godavari anicut, which may now be said to have arrived at completion, through the unceasing exertion and energy of Colonel Cotton and the officers associated with him in this great undertaking.

"It must be a highly gratifying termination of Colonel Cotton's immediate connection with the First Division, that he should have been enabled to notify to Government the complete stability of the anicut, and the success which has up to this period attended his plans ; and in congratulating that officer on these happy results, the Governor in Council has much pleasure in recording his obligations to Colonel Cotton, Captain Orr, and the officers of the department under their orders, for their services on this occasion ; and it will be his agreeable duty to bring the same to the notice of the Honourable the Court of Directors."

Later, the Court of Directors joined in this chorus of well-deserved praise. They declared they were constrained to record their very high opinion of the science, practical ability, and indefatigable labours of Major Cotton. "It is scarcely possible," they added, "to place that officer's qualifications as an Engineer of hydraulic works higher than they stood before, but the Godavari anicut is a new and splendid illustration of his powers of mind and self-



devotion, from the exercise of which the country has already so largely benefited."

This must have been highly gratifying to the officer praised. But, it is certain that he received as much gratification in the recommendation which followed that the works be prosecuted with all possible diligence, and that the opening of the Rallee and other irrigating channels, required to extend to all parts of the district the benefit of the anicut, would receive early sanction.

ENTHUSIASTIC PRAISE FROM BENEFICIARIES OF IRRIGATION.

How greatly and gratefully what has been done is appreciated by those who have benefited therefrom, may be best stated in the words of the President and Members of the Local Reception Committee, Bezwada, a town on the Kistna, addressed to Sir M. E. Grant Duff, K.C.S.I., when, as Governor of Madras, he visited the northern districts. In their address the people say :—

"We, the President and Members of the Local Reception Committee, in the name of the people of Bezwada, desire to give your Excellency a right hearty welcome to this flourishing town. Perhaps no place in India more exemplifies the benefits of British rule than the picturesque spot you are now honouring with a visit. Before the beneficent scheme for irrigating this thirsty land came into operation, Bezwada was only a small village, and partly in ruins, from the people having died in the terrible Nandana famine, *i.e.* the Guntoor famine of the Nandana year, 1832. Now it is a town, and increasing year by year with such rapidity as to be a source of wonder to all who knew its former condition. Indeed, it seems likely to become again, as in ancient days it is said to have been, the largest town in these parts. In past times no part of India suffered more than this from the horrors of famine ; and your Excellency's father pointed out the territory between the Godavari and Kistna as liable to these visitations in their severest form, and put on record a very terrible one. It often happened that whole villages were depopulated, and myriads of people perished for want of the water that flowed in abundance at their feet, and only just below the level



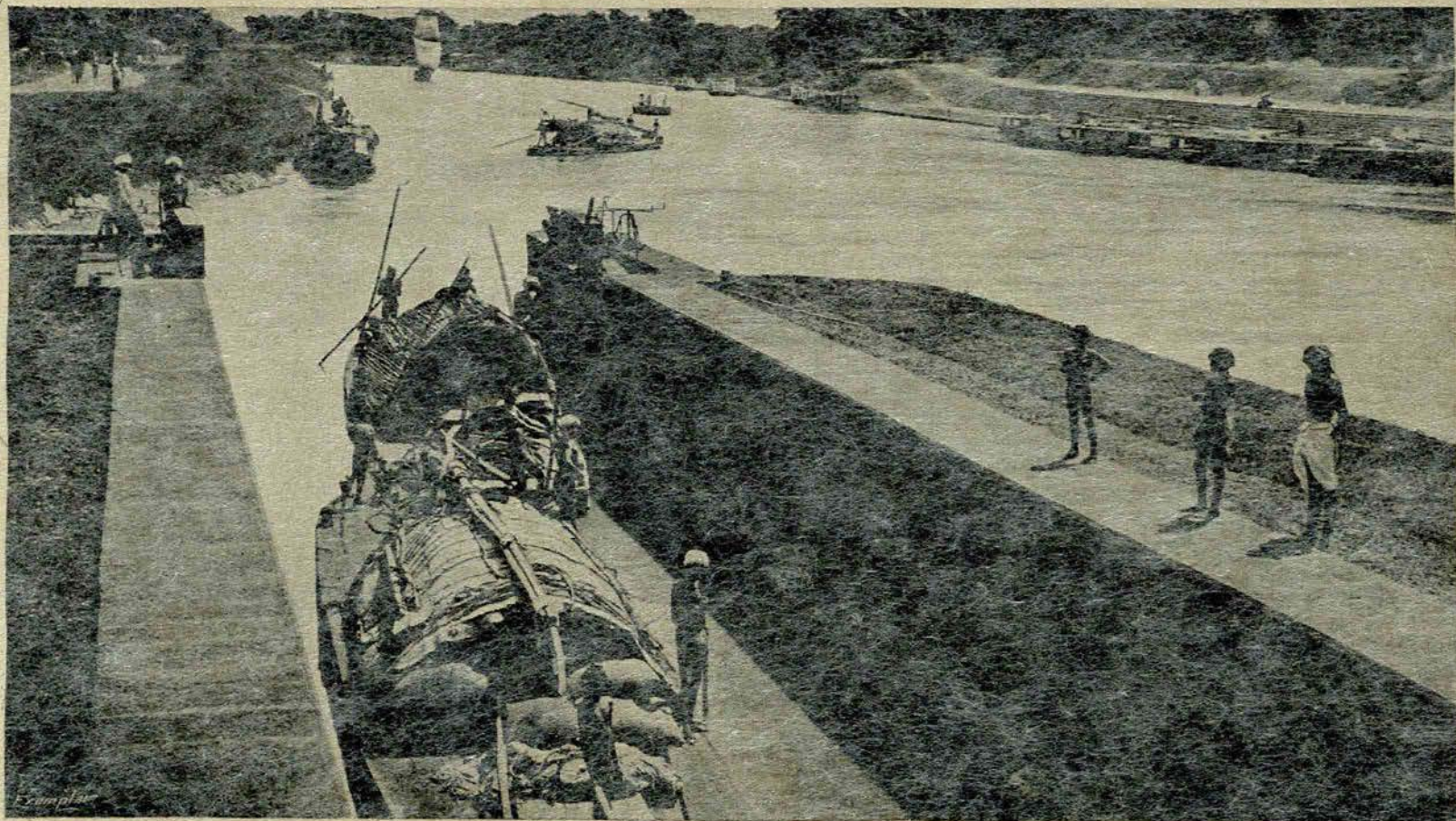
of their dying crops, to be swallowed by the greedy ocean. As the huge volumes of water flowed grandly on, laden with rich, fertilising, yellow silt, gathered by the river in its course through the Deccan,

THE ENTHUSIASTIC GENERAL SIR ARTHUR COTTON CALLED IT
'LIQUID GOLD.'

The anicut, with its ramified system of canals, has certainly turned it into solid gold. At one stroke the mouths of a hungry and dying people have been filled with bread, and the coffers of the Government with money. In place of dashing madly on to be lost in the sea, the Kistna now spreads fertility and beauty on all sides, and had your Excellency come at a later period of the year, the extensive tracts of flat country between this and the coast would present you with a sight worth seeing. No longer struggling for a bare existence, or held in the grasp of sowcars—money-lenders—the people rejoice among their smiling crops, and the money-lenders have become almost extinct. Even in famine years the Kistna never fails to do its duty, and the dire poverty that existed during the childhood of middle-aged men is almost forgotten in the general prosperity; and it is meet that we should express gratitude to the good Government that has done these great things for us."

Like many others who have been privileged to work with Indians, Arthur Cotton found not a few upon whom he could rely, and whom he could trust implicitly. Pre-eminently amongst these was a Hindu Overseer named Veenem Veranah,¹ who seems to have been gifted with

¹ Such another one comes under my notice whilst I am revising these pages. Writing from Jaipur, Central India, on May 1, Mr. Nash, special correspondent of the *Manchester Guardian*, whose testimony to the value of irrigation canals will be quoted later, speaks: first, of Colonel Jacob [a man after Sir Arthur Cotton's own heart], and next, of his Indian assistant. "I am told that when Colonel Jacob goes about the country, the people of the irrigated districts surround him as if he were the god of water, and beseech him to give them canals. . . . The genius of the nullah is a famous organiser of transport, Dhaupat Rai, whose name will be familiar to officers who have been on service on the frontier and in the Soudan. Dhaupat is now in charge of the Imperial Service Transport Corps of Jaipur State, which he has turned to good use for famine purposes, and he is cultivating the nullah and organ-



HEAD OF MAIN CANAL, EASTERN DELTA.



exceptional qualifications for conducting engineering operations as well as for directing and managing large bodies of native labour. Of him Colonel Cotton thus wrote: "I cannot say less than that if we had not found an Indian of his remarkable qualifications, considering the state of the district when the works were commenced, I do not see how they could have been executed, for no European could have supplied his place, and no Indian at all equal to him has appeared." He was made a sub-engineer with the title of Rai Bahadur, and continued for many years to render excellent service in connection with the enterprises to the successful accomplishment of which he had so largely contributed.

On one of the walls of the anicut there is a tablet bearing the following inscription :—

V. VERANAH GARU,
RAI BAHADUR,
Sub-Engineer, D.P.W.,
Obit, Oct., 1867.

Soon after the completion of the anicut, Arthur Cotton became Chief Engineer of the Presidency, and the charge of the Godavari works was assumed by his brother, Major (now General) F. C. Cotton; Captain Orr, who had been the chief executive officer in their construction, was placed in charge of the Kistna anicut, which is only second to the Dowlaisweram anicut in the grand results following from its construction.

Among those to whom tributes were paid was the sub-Collector, Mr. Henry Forbes. Of him, in warm language

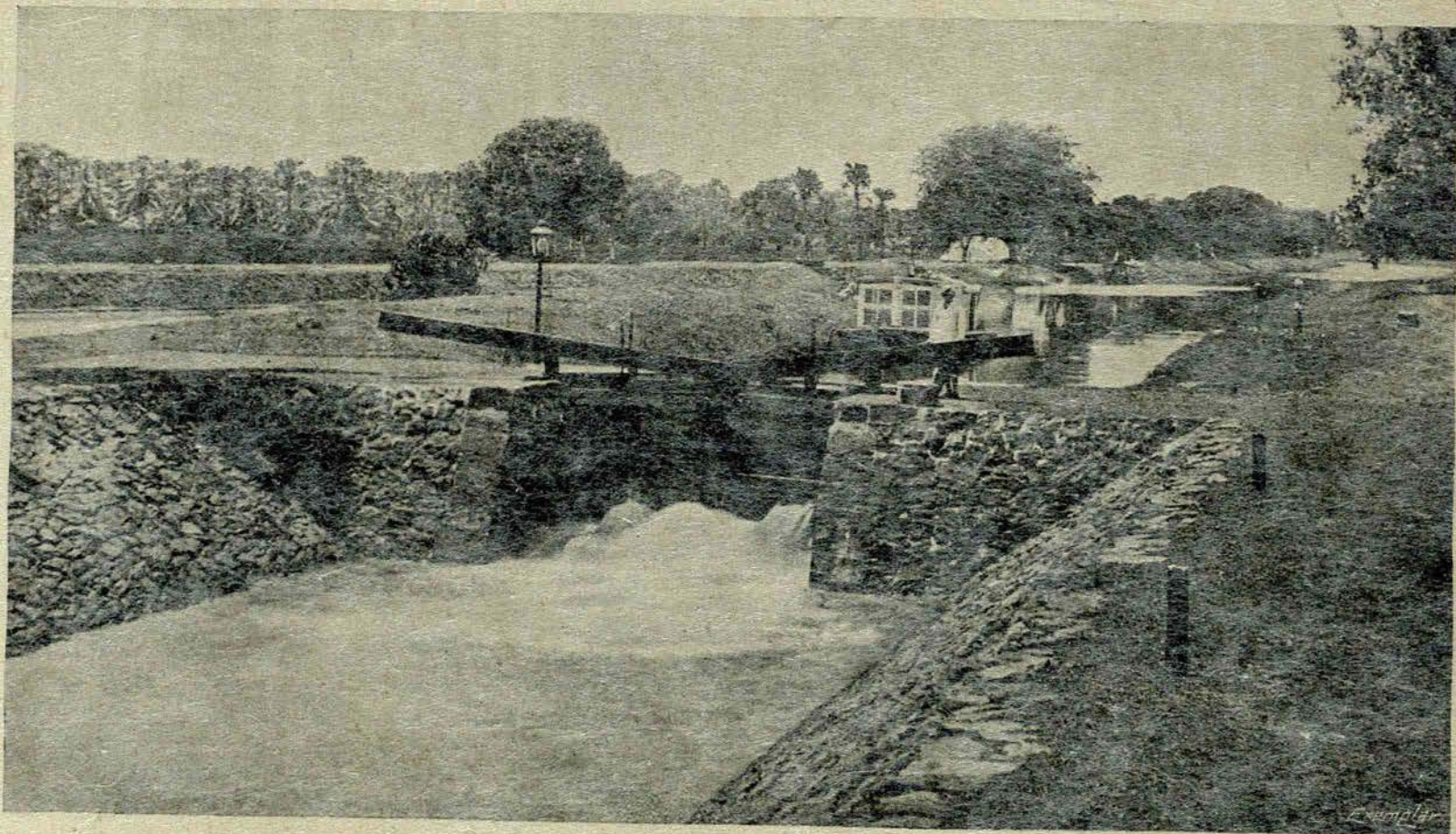
ising the 7,000 workers employed in it as a sort of amusement. The little finger of this entirely competent person is worth a whole famine code and a league of red tape to the Jaipur durbar. His huts are dug out and solidly thatched; his gangs of workers know exactly what is the daily task, and do it; his orphans, clad in surprising jackets of yellow, are governed by five orphan corporals; his ambulance wagons are well horsed; and his depôts for the collection of the sick and starving are run with military precision."



of grateful eulogy, Sir Arthur wrote: "That we have made the progress that we have is entirely owing, under God, to Mr. Henry Forbes, whose vigorous and active measures have already raised the District to a degree that could not have been expected; it may be said indeed that, as respects the getting public and private improvements effected, this District is ten years in advance of what it was a few months ago."

A STEAM TUG, AND HOW IT WAS OBTAINED.

Included in the many difficulties which sprang up, and which had to be removed, was the provision of a steam vessel. The plant or apparatus for carrying on the works was found to need a steam-tug, to be obtained from Calcutta. Sir Arthur, having heard of such a vessel, applied to the Board of Revenue to sanction its purchase by him. They did not see fit to comply with his request, telling him that it was not necessary; he, knowing of what value it would prove in oversight and direction and, if need arose, for towing purposes, went to Calcutta and purchased one on his own responsibility. He considered it absolutely essential to the progress of the works at that time. When he had paid for it, he was met by what appeared to be an insurmountable difficulty; the Bay of Bengal was held to be too stormy a sea for the transit of so small a boat. Just as he was wondering what could be done in the matter, a man came to him and informed him that if he were only trusted, he, with one or two others, would take the boat safely down the bay and place it in the mouth of the Godavari, and that they were ready to do this at once. He accepted the offer, and in a very short time the steamer was plying up and down the river, and proved to be of very great use. So much was its value proved, that a small flotilla of similar steamers was built, and the authorities at Madras eventually generously acknowledged that they were not only a useful adjunct but were essential to the progress and completion of the enterprise.



MUKKAMALA LOCK.



Year by year Arthur Cotton's conception came nearer and nearer to fulfilment. Canal after canal, channel after channel, were made and opened, and ever more and more acreage was brought under the influence of the vivifying waters. In 1853 he expressed his satisfaction at seeing considerable progress made in cutting the great channels for draining the country near the Colair Lake. About a quarter of a million of cubic yards of earth had already been excavated, and about four thousand people were at work upon them. They were to complete a million cubic yards that year, and thus open the two main lines to a considerable breadth. "This alone will have so powerful an effect as to relieve this tract effectually when the rains are moderate; and," he adds, "I have no doubt that it will give a new character to the cultivation of this tract this year, by enabling the people to begin their cultivation much earlier."

It must have been with mingled gratification and sad reminiscence that he found himself able to write: "From about this time the success of the works became so apparent that money was more readily granted for their development."

So far, in these pages, the Godavari canals have been regarded in their aspect as irrigating media. Nothing has been said of their usefulness as respects navigation. But, though these pages have been temporarily silent on that point, Arthur Cotton's mind was not, for one hour, unmindful of the great service which his water-ways might render to the country in this respect. Indeed, he designed them almost as much for boat-traffic as for field-inundation. By this time, so strongly had he become convinced of the utility of, and even necessity for, the provision of cheap transit, that it is doubtful if he would have designed works which could not be made to serve the double purpose. There were arguments in plenty in favour of his views, not the least of which was that cultivators were frequently reluctant to take an irrigation supply unless they were assured



of water carriage to take away the surplus crops which, without such opportunity, would be a drug to them, and would not repay the cost of cultivation.

IRRIGATION CANALS AS NAVIGATION ROUTES.

In the year to which we have now come—1853—he wrote :—

“The necessity for channels does not depend upon a great increase of exports, though that would render them much more valuable and important, nor even upon an export trade at all. The District must have communications for its internal traffic, whether it exports or not. A million of people cannot exist without interchange of commodities. And it is very much cheaper to make the irrigation channels navigable than to make roads ; besides that, the former will convey goods at a twentieth part of the rates by the latter.

“Again. The question seems to me rather to be what data are there to conclude that the export trade, which has increased in ten years from £30,000 to £140,000, should on a sudden become stationary, and that, too, when the quantity of produce is increasing, and the cost of obtaining that produce decreasing every year in consequence of the new works. The market for rice, tobacco, sugar, and oil-seeds is, in fact, in comparison with the extent of this delta, almost unlimited, and the quantity that will be taken from it depends upon one main thing, the cost of its production. If Rajahmundry can grow these things cheaper than it did, it may export a hundred times what it does now. The new works will certainly reduce the cost of produce, on an average, one-half and (of course always excepting extraordinary contingencies) nothing can stop the present increase of the export trade, unless we absolutely prevent the produce being conveyed to the coast by want of communications. I am informed that there is again a great increase of the export trade this year.



"The grounds on which I insist upon the necessity of making the channels navigable are these:—

"First. The actual present traffic on those that have been opened is abundantly sufficient to prove the necessity for them.

"Second. There is now a large and rapidly increasing foreign trade, the materials of which must be carried from the interior to the coast.

"Third. Among a population of close on a million of people there must be a large interchange of goods, if there are communications.

"Fourth. The delta is wholly without roads.

"Fifth. It is much cheaper to make the irrigation channels navigable than to make roads, and they are incomparably better means of transit.

"Sixth. To supply the people with means of raising a five-fold amount of produce, and give them no means of conveying the surplus to the towns and ports where it may be converted into money, seems to me the most palpable mistake.

"Seventh. If only one hundred thousand tons are moved by the channels annually (the exports alone are from forty thousand to fifty thousand tons already), and they are only conveyed on an average thirty miles, the cost of that traffic by land would be £40,000 a year; whereas by water it will not exceed £4,000, so that it would be equivalent to relieving the district from a charge of £36,000 a year, even if there were roads.

"Eighth. The cost of the navigation will be quite insignificant, perhaps on an average £20 a mile, the interest of which, divided among a traffic of only ten thousand a year, would be only one twenty-fourth of a penny per ton per mile; and for this the cost of transit would be reduced one penny farthing, even as compared with common roads, which would cost three or four times what the navigation will.

"Ninth. I must always insist upon the fundamental principle that where there is a considerable population



it is the communications that make the traffic; and if there is little or no traffic the sole reason must be that there are no communications."

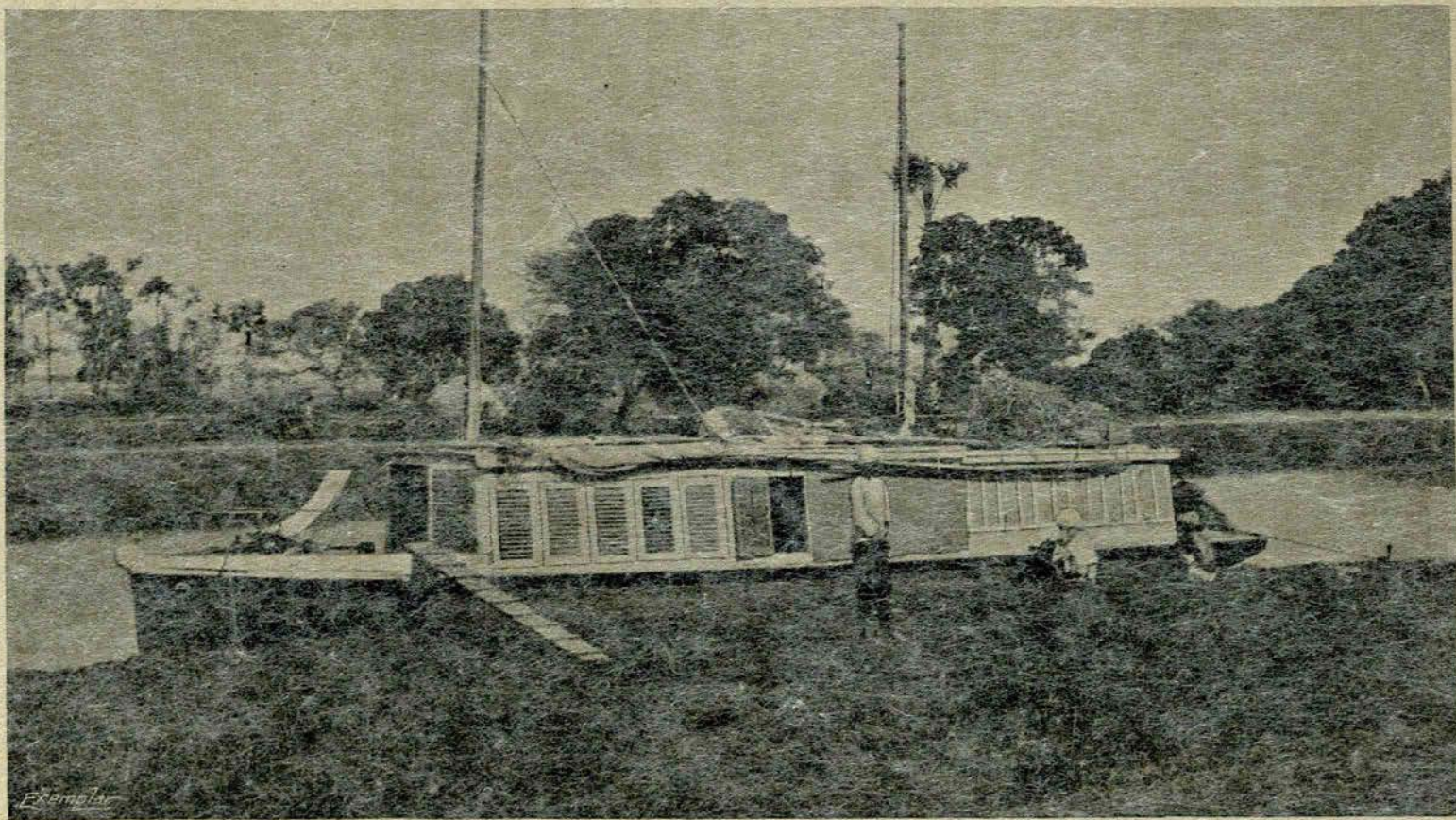
Quoting the above, Mr. Walch, in his book on the Godavari delta, proceeds to remark:—

"And so he went on with steady insistence, loyally backed up by the officers who followed him on the Delta Works; and there are now in the Godavari system alone nearly five hundred miles of canals which, besides carrying water for irrigation, are excellent lines of communication. Nor is this all. From the Godavari system navigation can, at three places, pass into the Kistna system with its three hundred miles of navigable canals, and from it again into the Buckingham Canal, which runs along the coast for one hundred and ninety-six miles from the end of the Kistna system to Madras, and for sixty-five miles further south. From Cocanada to the south end of the Buckingham Canal the length of canal navigation is four hundred and fifty miles.

"There cannot be the slightest doubt that the provision for cheap carriage, not only in and about the district itself, but also to the neighbouring districts and to an excellent seaport, contributed largely to the rapidity with which the Godavari irrigation developed, and the district sprang into prosperity. In this way the cost of the works especially required for navigation has been repaid over and over again, quite irrespective of the direct returns from boat licenses, and so on."

Thirty years later (1883) General Mullins, R.E., Chief Engineer for Irrigation, wrote:—

"The Irrigation and Navigation Works of the Godavari delta may well be a subject of congratulation, and I fully join in the opinion expressed by the Government of Madras, that the usefulness of this most successfully executed project, the development of which has been steadily going on during the last thirty-five years, is by no means to be measured by the direct pecuniary returns only, large as they have been. The present flourishing



A HOUSE-BOAT FOR CANAL TRAVEL IN EASTERN INDIA.



condition of the Godavari district, and the vast improvement it has undergone since the construction of the works, which provide for the irrigation of nearly six hundred thousand acres, afford the best possible evidence of the great benefits conferred on the people."

Still later, in January, 1890, further most interesting testimony is forthcoming concerning the navigation aspects of the district. The Hon. J. D. Rees, C.I.E., Member of the Viceregal Council, writes :—¹

"After a brief halt at this historic site (Masulipatam), we travelled on along the coast of the district, which, in size, is about equal to the principality of Wales, and next morning arrived at Cocanada, in the Bay of Coringa, ten miles north of the Gautami mouth of the river Godavari. To the north and north-east of the anchorage low hills come down near the water's edge, relieving the coast from the barren and desolate appearance that it presents near Masulipatam. The harbour was alive with boats bearing on their sails huge red crosses, anchors, moons, and such-like devices, whereby their owners may recognise them from the distant shore. The collector, Mr. Power, met us on board, and another voyage of six miles in a steam launch landed us between the groynes, which form, at once, an entrance to the town of Cocanada, and to the canals which extend thence to the great anicut of the Godavari, since the construction of which the trade of the town has advanced by 'leaps and bounds,' the value of its exports and imports having risen from £300,000 in 1862, to £740,000 in 1872, and £1,500,000 in 1888.

"Next morning, the 23rd, we rose early and left by canal for Rajamundry, a distance of forty-four miles, more or less. We were towed along, in a little convoy of house-boats, by the steam launch *Arthur Cotton*, named after the celebrated engineer who constructed the great Godavari Irrigation Works. In the river, from the head of the delta, there is a continual fall, consequently we had a continual rise, and passed three locks, one a double one, with a rise of eighteen feet. The canal banks were green,

¹ *Narrative of the Eleventh Tour of His Excellency the Right Honourable Lord Connemara, G.C.I.E., Governor of Madras, by J. D. Rees, Private Secretary.* I am indebted to Mr. Rees for his kind permission to make these quotations.



and banyans shaded the road, which ran alongside. All around us were fields of stubble, and innumerable straw-ricks. The character of the country, but for the palmyras, much resembles that of the Fens. When you get within a few miles of the great dam which stems the stream at Dowlaisweram, first one canal and then another takes off in different directions. After the separation of each canal the artificial waterway grows broader and broader, till, near Dowlaisweram, it becomes as wide as the Thames at Maidenhead, but probably contains a great deal more water. At last it ends in a lock; and, when we leave the boats and mount the banks, an expanse of water stretches some four miles before the eye. Immediately in front extends the first portion of the great anicut, which, with the help of three islands at the head of the delta, holds up the river, and diverts its waters on either side, so as to irrigate upwards of 612,000 acres of fertile rice-bearing lands, and to water with gold a delta of two thousand square miles. Every river in India is a Pactolus, but this great stream has been made more subservient to the wants of man than, perhaps, any other of its size in the world. Practically, at the present moment, it ends at this great anicut above which you see nothing but miles of water, and below which spread miles of yellow sand.

“It is the nature of such works that they are never finished. In 1852, the dam and some of the distribution works were completed for the exceedingly low figure of £150,000. Labour was then cheap, and material abounds on every side. Many times since have these titanic works been considered complete. In 1870, eighteen years later, they were completed, at a cost of £868,000, and now, in 1890, it is believed they are pretty well completed, at a cost of £1,180,000. Whatever they cost, however, so long ago as 1877, the returns directly due to the water distributed amounted to upwards of £2,000,000, and in 1879 it was calculated that goods of the value of upwards of £3,500,000 passed over the canals, while the value of the exports and imports of the district, which, in 1847, before the construction of the anicut, amounted to £170,000, had risen, in 1887, to upwards of £1,500,000. The great dam itself rises some fourteen feet above the level of the stream, and consists of three long portions and one short one, amounting, in the aggregate, to 3,982 yards in length. The navigable channels, which distribute the water, are



528 miles long, and the total lengths of distributive channels is not less than 1,600 miles.

"These steamers belong to the Irrigation Department, but fleets of private boats ply on river and canal, and carry passengers at ridiculously low rates. Competition has reached such a pitch that rival carriers are said to take passengers occasionally not only for nothing, but also to give them bananas to eat on the way. Nothing like this has yet been exhibited in England; though, occasionally, you can go from San Francisco to New York for the price of a journey from London to Edinburgh, from causes similar to those which operate here."

THE EXTRAORDINARY CHEAPNESS OF CONSTRUCTION.

It is sometimes urged that high prices must needs be paid for construction which is to last for many years. There are, doubtless, occasions when this is true. But there is no special virtue in high prices as such. That work is most deserving of praise which is most enduring and has cost least. Tested by this standard, Arthur Cotton's work everywhere, but especially in the Godavari delta, stands second to none. A Committee appointed to make an investigation into what had been done at Dowlaisweram anicut bore this striking testimony:—

"The rates are singularly low and, were each of them increased fifty per cent., the anicut might then be pronounced one of the cheapest works ever constructed, if its immense length, and its situation, with the endless difficulties arising therefrom, were duly considered.

"FOUNDER OF CHEAPEST SCHOOL OF ENGINEERING IN THE WORLD."

"And, it must be added, that this extraordinary cheapness was owing to the peculiar section of the anicut. It may, indeed, be safely affirmed that, had the works been projected by any other living engineer, their original cost would have been prohibitory. The comparatively small work of the Barrage in Egypt was built with the same object (as was this anicut) and cost £1,800,000, and was after all wanting in the security of the Godavari works.



This economical method of construction, originating with Colonel Cotton, has influenced the design of other similar hydraulic works in the Madras Presidency, and was the result of Colonel Cotton's appreciation of the old native engineers in India. So that there was no rashness in the design of the Godavari anicut section. It was simply confidence gained by Colonel Cotton's study of the ancient works, the stability of which had been proved during the lapse of ages. And thus he became the founder of the cheapest school of engineering in the world, as the Madras Engineering School undoubtedly was. Nor is it too much to say that if that school were fully understood, it would save millions of the money now being spent in all parts of the world, in retaining water for the supply of its great cities."

To the general reader the interest in the work lies mainly in the incidents of the hot official warfare which raged round this gigantic enterprise from beginning to end, and which seems to have been in no way relaxed even when the victory had been assured. The records teem, it is stated, with remonstrances from Colonel Cotton, and with replies, "now wrathful, now penned more in sorrow than in anger," on account of surprises sprung on the authorities in ever-increasing demands for funds. Well worth reading, as a commentary on Indian administration, is Colonel Cotton's despatch of November, 1852 (sent direct to Government in violation of all ordinary routine), with its pent-up indignation, restrained only by the soldier's sense of discipline; its withering complaints of the want of support; its entreaty for inquiry and inspection, for his "disappointment is that too little, not too much, interest has been shown respecting the works."

"An angry reply from the Governor seemed likely to bring things to an *impasse*, but the tide had happily turned, and the next report was so highly encouraging, that henceforth money was more readily granted; so that on one page we find a list of sums sanctioned on these works, at



thought of which a few years earlier the revenue authorities would have stood aghast." Eventually there was recognition, "and in 1882 we have a notable despatch from the Secretary of State in which the total expenditure of £1,300,000 is reviewed, and which contains a cordial and gratifying acknowledgment from the Home Government of the success of the Works."¹

To these remarks I add some notes, which have been given me by my uncle, General Fred. Cotton, on the valuable lesson of building dams in sandy beds.

"I think I am right in saying," says General Cotton, "and it may be of interest to those who are following Sir Arthur in his work in Hydraulic Engineering, that the most important step in his education was the lesson he learnt from the builder of the so-called grand anicut, which carried the surplus water of the Cauveri river into the Coleroon. This low weir is of unknown age, and, from its importance to Tanjore, always has been carefully watched. Every year some small sum has been expended in restoring any breakage of its plastered surface, and it was well this attention was paid to it. For on its being cut into for sluices being opened in it, which had for their object the removal, by the water discharged, of the accumulation of land in the Cauveri, it was found that this 'Grand' anicut work was hardly more than a mass of rubbish, mud, stones, and logs of wood, the safety of which depended solely on its then plastered surface. This was a fact not lost upon Sir Arthur, and it gave him, even with the slender means extended to the engineers of that period, the power to master and control the greatest river of the country. The fact was learned from an engineer of old times, but the courage with which Sir Arthur put the idea into practice in his great works was all his own. And, as been said by more than one of his profession, no English Engineer would have risked his reputation on the works he carried out so triumphantly. The four anicuts he built across the Godavari are not solid masses of

¹ "An Indian Romance." *Blackwood*, June, 1897.

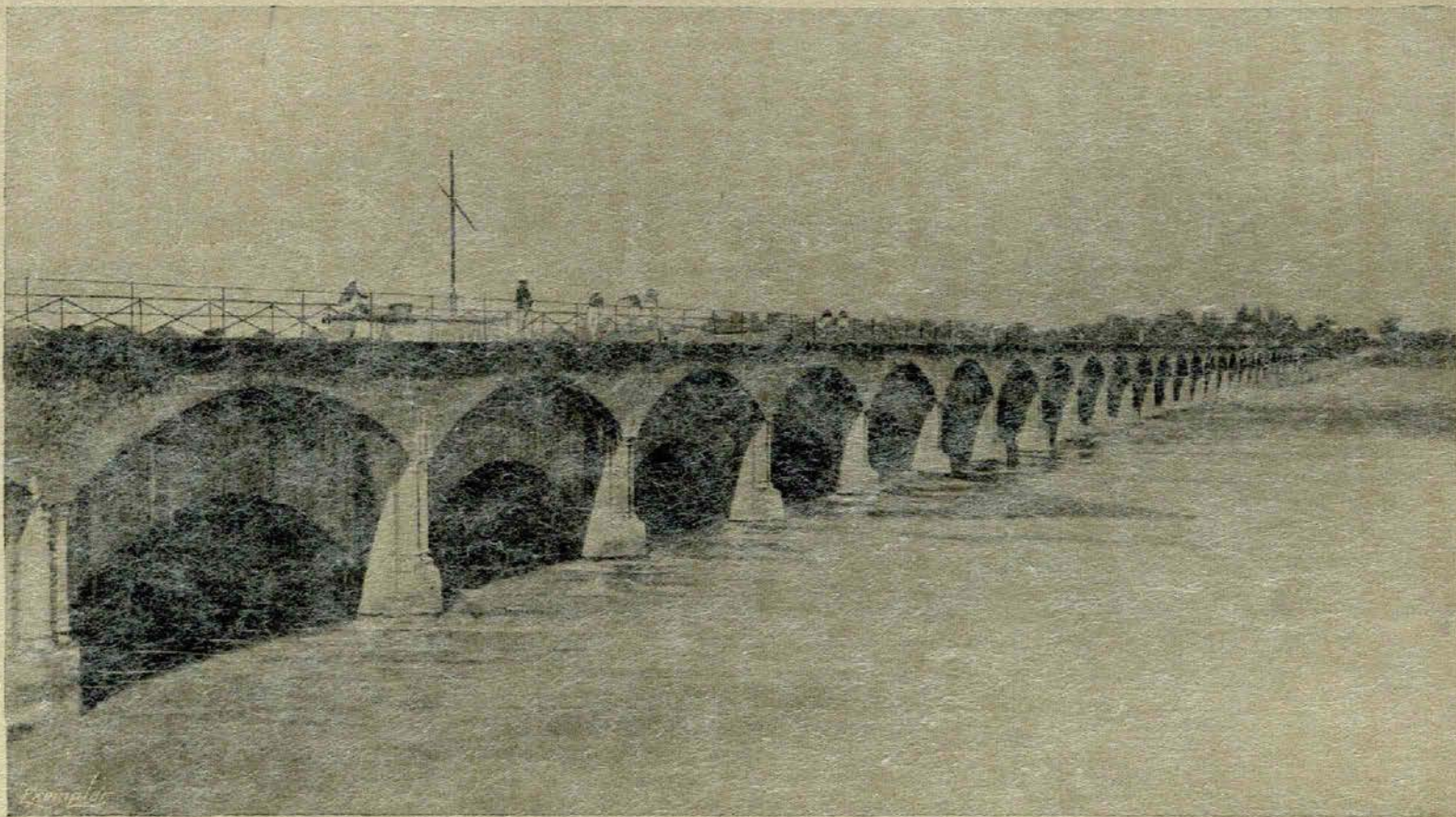


masonry, but surface coatings of stone over the sand of the river bed, for which he substituted cut-stone for the plaster of the early engineers, but the principle was the same. The erections of these great works are not sufficiently studied in the present day. Indeed, the cheap School of Engineering, which he did much to introduce is, it appears, set aside for the extravagant system of England. And, after all, what is good engineering but economy! Any engineer can do anything with money; the question is how to do great things at little cost. In the sections above referred to, the use of well foundations is exemplified. The upper and lower retaining walls have wells for their foundation in sand of unknown depths. These wells are only six feet deep, and their sufficiency has been proved often; yet one hears still that in other parts of India, where they have been sunk in foundation, it has been thought necessary to sink them thirty or forty feet, till they come upon some solid ground stratum. It may be noted that a lighthouse, which had to be built on the sandy beach, on the coast of Madras, is founded upon wells eight feet deep, and never showed the slightest settlement."

Agreeably to a suggestion from the Board of Revenue, Major Cotton modified his section of the anicut¹ in the manner described in the following letter:—

"In reply to your letter respecting the mode of executing the curved surface of the anicut, I have the honour to reply, that I was afraid that the forming of the surface of the anicut with large stones, rudely fitted, would cause great delay, as every stone must be fitted on the work; however, upon considering the matter, though the stone is entirely without any regular shape, as in the localities mentioned, I thought it might be done sufficiently quickly; and I determined at all events to make a fair experiment, and I am happy to say that the result has far exceeded my expectations; about twenty-five square yards of half

¹ The character and extent of the modification will be found in the Irrigation Map of Godavari, which faces page 122.



THE GUNNARAM AQUEDUCT CROSSING THE GODAVARI RIVER.



a yard thick, composed of large stones, were prepared by crowbar men and stone-cutters at a cost of about fourteen annas a cubic yard, which would give under four shillings a cubic yard, including chunam (mortar), bricklayers, etc., the estimated rate for cut-stone being ten shillings. This was so well fitted that, with a good cement, it would do for an apron with an overfall, if the blocks were of a large size. I therefore consider the suggestion contained in the Board's letter a most important and valuable one. It seems entirely to remove the main difficulty in the execution of the work, as probably we shall be able to procure sufficient stone-cutters to complete the work in two years, if this kind of masonry is substituted for cut-stone everywhere, except in the lining of the sluices.

"The curved surface of the work according to the second section, if covered in this way, will be exceedingly strong, and much better than if covered with concrete, and the work will be considerably cheaper altogether than if it were executed according to the section first proposed."

Besides the anicut, which crossed the Godavari itself, an aqueduct of forty-nine arches, each of forty feet span, was built across an arm of the river. This was built entirely in one short season, and then overwhelmed with a flood, which subsided without having injured the work.

At no time did he claim that his work was perfection, though there are few men responsible for large undertakings, who came so near that ideal as did he. His own simple confession is contained in these words:—

"I cannot say that we have obtained all our experience without mistakes and accidents. There have been many of both; but we have found that they have helped to give us our present knowledge of Hydraulic Engineering in India, and a confidence which we never could have had, if we had attempted nothing. By God's blessing, all the great works were in the main successful, and are now in profitable operation."

"I have not the least doubt," he adds, "that both communications and irrigation will everywhere produce pro-



perty to the value of much more than twenty times the outlay. The fact is that India, in its present unimproved state, is a mine of wealth far beyond that of any gold mine in the world. The richest mines in Australia only produce three and a half times the value of the labour bestowed on them, a man whose labour was worth £35 a year earning on an average £120 a year in mining."

Amongst the schemes now suggested, and for which estimates were sent in, there was one for works required in the central delta, between the two main branches of the Godavari. The chief of these was a great aqueduct already alluded to, remarkable in construction both in regard to boldness of design and execution.

Another was for providing irrigation to the lands on the left bank of the North-eastern Godavari: it included, among minor works, a channel twenty-four miles long to water forty-five thousand acres, and to become one of the great lines of navigation connecting the town and port of Coringa with the Godavari above the anicut, and so with the large towns of Ellore, Masulipatam, and all parts of the delta.

In reference to this matter he wrote: "How enormous is the loss sustained by the want of communications! No wonder the country yields so little revenue when the people are put to so great an expense merely for the conveyance of produce. If, as I feel confident is the case, a loss of much more than £7,500 would be sustained in the carriage of produce by this one line of thirty miles, if there were no canal—a line very far indeed inferior in extent of traffic to hundreds of miles of road in this Presidency—how large a proportion of the value of the labour of the population must be thus wasted! The money expended upon this channel, which, when completed, will be thirty-one miles in length, is about £5,000; probably £6,500 in all, will be the cost of it, or about £200 a mile. But this includes the making it a very capacious irrigation channel; and one half of the cost, at least, may



INCREASED CHEAPNESS OF PRODUCTION 143

be charged to the irrigation, leaving only £100 a mile for its cost as a navigable channel, a sum which, on *the calculation given above of fifty thousand tons a year, at two annas a mile, the cost of land carriage, would be repaid in two months.*

"The goods conveyed along it in the last three and a half months, that is, during the dullest time of the year, would have cost £1,500 to convey them by land, more than they have cost conveyed by water while the channel is yet in a very imperfect state.

"When people are relieved from this burthen, how can there be a doubt that a land revenue, which otherwise would be sufficiently heavy to paralyse the ryots, would leave them a surplus sufficient to enable them to be continually improving their lands?

"What becomes of the extraordinary idea that the country may be ruined by growing food too cheaply? The fact is undeniable that the districts that yield the largest revenue, in which the people are most comfortable, are those in which, by means of public works, the food is raised at the least expense and in the largest quantities. Tanjore, which for a long series of years has raised the greatest abundance of food, is that district in which land is most valuable; nor can a single instance be found of a district falling off in any way from the increased cheapness of production.

"It is easy to see that in the long run, a district which has to pay ten lakhs of bullion every year, to be sent to a distance, can much more easily do so when its food is grown so cheaply that it can afford to produce things cheaply for markets from which it can obtain bullion, than when the dearness and scarcity of food prevent it from selling things in other markets at a price which renders them marketable.

"But, whatever the theory is, the fact is undeniable that where grain is grown cheaply, a district flourishes, and the cheaper it is grown the more the district flourishes.

"It is not money, it is action which is wanted. If a small



portion of the money which is idle in every treasury were judiciously expended on public works it would not cause the smallest, even temporary difficulty, but would immediately improve the revenue collections, even those of the year in which the expenditure is made."

This chapter, perhaps, cannot be more fittingly concluded than by one more passage from his facile pen. Often speaking of the people's new resources, and consequent ability to trade with other places, and to purchase goods, from the want of which they had previously suffered severely, my father writes with regard to the increased traffic of the districts: "I am convinced that this prodigious change may be taken as a specimen of what may be effected in every branch of the social condition of the people of India. Hope, and consequently life, has been thrown into this population. They now begin to find that it is better really to work, and thus to live in comfort, than to pass their lives in sloth and abject poverty."

APPENDICES.

Taken from Mr. J. H. Morris's "History of Godavari."

I.—PROSPEROUS HOUSEHOLDS IN GODAVARI.

The ordinary dress of a ryot is very simple. Its cost varies according to the quality of the material, but the average value of a man's costume is from two to five rupees. It generally consists of a lower garment (dhóoti), of an upper garment (uttariyam), and of a turban or head-cloth (pága).

The house usually occupied by an ordinary ryot is as simple as his costume. It consists of one or two rooms built with mud, and thatched with palmyra leaves. The ploughing oxen, or the cows, frequently occupy part of the same building as the family. A few earthenware pots and brass utensils comprise the whole of the furniture, with the exception, perhaps, of a low cot or "charpoy," with the bottom made of tape. The increase of the family prosperity is chiefly seen in the better quality of the clothes worn, in the superior kind of food eaten, and especially in the greater number of jewels worn both by the men and by the women,



particularly on the occasion of the usual Hindu feasts. A prosperous townsman generally inhabits a rather larger house than the peasant does. His house consists, perhaps, of three or four rooms, with a courtyard in the centre. A raised chunam seat—called in the south a “pial,” and in the Telegu country *arugu*—is to be seen on each side of the entrance door, where the owner sits in the cool of the evening to hear the gossip of the day, and to chat with his friends. The utensils are very similar to those in an ordinary ryot’s house, only of a better quality, and more numerous. There are more brass pots and dishes, and other vessels, all being kept scrupulously bright and clean. Some of the cups may be of silver. Of what we call furniture there is none, except a few chairs in the houses of the most wealthy, who may desire to imitate European manners. Generally there are a few lacquered wooden boxes to contain the family jewels, cooking utensils and palmyra leaf books, or perhaps a mat or two, or a rug to sit on. The general articles of food are rice, dhal, curds, and buttermilk, tamarinds and ghee—that is, clarified butter—and vegetables. Some of the lower castes eat meat and fish. The lowest orders live on raggi, or on Indian corn. The average monthly expense of the household of the middle class is about thirty shillings, and that of an ordinary ryot is eight shillings (pp. 87, 88).

[The average income throughout India is only two shillings and tenpence.]

THE RIVER AND THE DELTA.

The magnificent river to be utilised, after a course of several hundred miles across the Peninsula, enters at about sixty miles from the sea the alluvial country, which it has itself formed. “This alluvial land does not immediately expand to a great width from the point at which the river leaves the main range of the hills, there being still rising ground and detached patches of hills at a distance of from half a mile to five miles from the river, for a distance of twenty-three miles further; at the end of which distance two or three detached hills come close to it, the river divides into two streams, the alluvial country spreads out on both sides, and the delta may be properly said to commence, extending on the west side till it meets that of the Kistna at the Colair Lake, about forty miles, and on the east side about thirty-two miles to the shore of Coringa Bay.” This was the delta which was to benefit by the projected irrigation. . . .



The country which was to be irrigated by means of the proposed anicut consisted, with the exception of a strip of sandy land bordering on the sea, of a noble expanse of rich alluvial land fit for almost any cultivation, if well supplied with water. It was estimated to contain about 1,300,000 acres, out of which, deducting one-fourth for sandy tracts near the sea, sites of villages, and channels of rivers, there would remain 1,000,000 acres fit for cultivation with paddy or sugar-cane (pp. 110, 111).

THE APPROVAL OF GOVERNMENT OF THE GREAT WORK.

The sanction and approval of the Madras Government were cordially given. "This great undertaking," they said, "appears to have been projected with the utmost care and circumspection. In 1844, the Government had under examination the general state of the Rajahmundry District, and entered upon a review of the causes, which led to the deterioration of the revenues and the depressed state of the ryots; and it appeared that the total neglect of the works of irrigation under the Zemindari system, the apathy displayed by the Zemindars towards the improvement of their estates, and the evils attending the temporary and partial management of the local revenue officers, were amongst the chief causes of the impoverishment of a province on which Nature has bestowed so many advantages in soil and situation. The time has arrived for the introduction of such measures of improvement as will tend to promote the prosperity of this rich but hitherto neglected province, and his Lordship in Council feels satisfied that no measure is more calculated to produce an extensive beneficial effect than the project now under consideration.

"There seems no reason to doubt that an anicut across the Godavari will be as advantageous to the Rajahmundry district, as the Coleroon anicuts have been to the Tanjore and Trichinopoly districts; and it may be confidently expected, not only that a large annual amount of revenue, now difficult to collect, will be secured to Government without pressure on the ryots, but that a vast extent of the richest land will be made available for the cultivation of sugar and other valuable products.

"The difference between the calculations of the Collector and the Civil Engineer as to the probable increase of revenue that may be anticipated from the anicut is considerable; but if it had no other effect than that of securing to Government the sum of



£9,000 now annually lost, the object of its construction would be sufficiently gained. But, when it is considered that, exclusive of the extent to which Major Cotton is of the opinion the District of Rajahmundry will be benefited, the anicut will enable nearly 820,000 acres of land to be brought under perfect irrigation in the district of Masulipatam, it seems impossible to estimate, or to limit, the prospective advantages to the people and to the Government, that the completion of such a work is calculated to produce.

“One other point affords the strongest argument in favour of Major Cotton's project, that is, the frequent visitations of famine with which the Rajahmundry district has been afflicted, and from which the inhabitants have so dreadfully suffered; and if, as there is reason to believe, the proposed anicut will preserve the population of that province from the frightful scourge, there cannot be a question but that its construction should be advocated. His Lordship in Council resolves, therefore, to bring the correspondence on the subject of the projected undertaking to the notice of the Honourable Court of Directors, with the strong recommendation of this Government, that sanction be granted for the disbursement of the estimated amount, namely, £47,557, and that their orders be communicated in time for the commencement of the work at the beginning of the ensuing year.¹

A FRIENDLY CIVILIAN.

That we have made the progress which we have is entirely owing to Mr. Henry Forbes, the Sub-Collector, whose vigorous and active measures have already roused the district to a degree that could not have been expected, and it may be said, indeed, that as respects the getting public and private improvements effected, the district is ten years in advance of what it was a few months ago. The people have come freely from all parts of the district, and both they and the native public servants now fully understand that the great improvements can be effected. The actual use of the Godavari water from the new channel as far as Samulcotta, over an entirely new tract, has also, no doubt, helped to enable the people to realise the practicability of improving the state of the district.

With respect to the estimate, as we have not yet trenched on the largest items, I cannot speak confidently, but so far as we

¹ *Minutes of Consultation of the Madras Government, Revenue Department*, under date September 1, 1846.



have gone, I think there has been a fair result for the money expended. About £15,000 will be laid out in railways, boats, buildings, and machinery, all which will be of use in the execution of the remaining works included in the estimate of £120,000 (p. 128).

A BIG GALE AND A HARD TEST.

On September 16, 1849, an unprecedented rise in the Godavari occurred, accompanied by a very severe gale of wind, but the nearly completed anicut firmly stood the unwonted strain. The highest mark on the standard register at Rajahmundry was 31 feet, but this year the fresh rose to 33 feet 5 inches there, and to the height of 25 feet 4 inches at Dowlaisweram. The works came out of this very severe trial comparatively uninjured, although a good deal of damage was inflicted on the buildings of the establishment connected with them (pp. 125, 126).

A CIVILIAN ESTIMATE OF THE WORK.

Mr. Henry Forbes, the sub-Collector, wrote: "I cannot leave without regret a work which has been my daily occupation, and a source of constant interest to me, for four successive years; but I have seen it advance to such a point that my regret is unmingled with anxiety. Difficulties are now at an end; the Godavari is dammed from bank to bank; and to complete whatever may be left of the cut-stone work at Vijeswaram and to cover with cut stone the Ráli and Maddúru anicuts, alone remains to be done.

"From March 1, 1847, to April 30, 1850, there has been expended among the labourers for daily hire £23,913; and the total number of daily labourers employed having been 3,054,413, or the total population of the province five times told. In addition to this, there has at all times been a large number, particularly in the quarry, on regular monthly wages; and in this present year, when the building operations have been most extensive, there have been in constant employ 641 bricklayers and 365 stone-masons, of whom 308 bricklayers and 231 masons have been supplied from this district. Of the coolies working on daily hire, and taking the average at 6,500, about 1,200 have been furnished from Masulipatam and 5,300 from Rajahmundry. In this district each taluk has been called upon to supply a fixed number with reference to its size and population. The village officers have among themselves arranged the details of the quota from



each village, and also for the regular relief of the parties at intervals of one month" (pp. 128, 129).

THE BENEFITS TOO MANY FOR ENUMERATION.

An endeavour has thus been made to give a brief, and, it is hoped, clear description of this invaluable work, as an appropriate close to the history of its construction. It would be difficult to enumerate all the benefits it has been the means of conferring on the people of the district, who still cherish the recollection of its founder in their household converse, and in their popular songs. "Peace hath her victories no less renowned than war," and few of her victories have such an enduring monument as the Godavari anicut (p. 180).

WHAT WAS DONE IN TWELVE MONTHS.

In the central delta the aqueduct has been completed, with the exception of the towing path. The channel above it, which had been almost destroyed by the river breaking in upon it in the flood, has been put in complete order, the main channel leading from it has been continued to tide water within four miles of the sea, and several miles of branch channels have been cut. It was highly interesting to pass over this aqueduct in a boat and see an ample stream of water thus thrown into the richest part of the district, in the height of the dry season, when a year before not a brick had been burnt towards the erection of this large work (p. 159).

THE CHIEF CIVILIAN OFFICIAL'S TESTIMONY.

I have thus endeavoured to describe both the anicut itself and the system of irrigation dependent on it, and to give an historical account of their construction. Little need be added in conclusion. It is impossible to overrate the value of these beneficent works. No one who has witnessed the very great advantage which they have proved to the people will consider that they have been the result of wasted or misspent money. The noble river, which formerly ran in comparative uselessness to the sea, has been restrained and bridled and sent abroad in a thousand channels to fertilize the land. The fluid, which is so precious in the arid climate of the East that it has been felicitously likened to "liquid gold," has been converted into capital, that has been repaid in what has proved better than the most enormous rate of interest, and has carried the blessings of fertility and contentment



and peace to a region which, as in the great famine of 1833, was formerly desolated by the most terrible scarcity and drought (p. 164).

THE EARLY HISTORY OF THE PROJECT.

The final portion of the following brief narrative will serve to show how, in 1854, after the anicut had been in existence for several years, there was, in high quarters, scepticism as to the work, while the bit of early history calls for record:—

The whole story is so instructive that I cannot refrain from giving it a little more at large.

In 1779, Mr. John Sullivan, in his letter of February 3, fully explained to the Court of Directors the necessity for storing the waters of the Kistna and the Godavari.

In 1788, Lieutenant Lennon represented to the then Governor of Madras, that he had, in 1786, at his own expense, made a survey of the Godavari as far as where the Shevaroy falls into it.

In 1792, the Court of Directors, in their letter to Fort St. George, recognised the expediency of surveying the Kistna and Godavari, both with a view to irrigation and navigation. About thirty years after, the enterprising firm of Messrs. Palmer, at Hyderabad, attempted to navigate the Godavari as a private speculation, but were compelled to relinquish it, principally on account of the exactions of the various petty chieftains on the banks. It is only, in 1847, that an anicut is commenced across the Godavari. The paltry sum of £1,000 has only just been sanctioned by the Supreme Government for the survey of the Godavari, after a former refusal; and the last issue of the *Athenæum*¹ contains an account of the progress of the expedition of discovery as high as Chinnoor, two hundred and fifty miles from the port of Coringa. In spite of this, our present Governor, in his Minute on the Public Works Report, still continues to doubt whether the river will prove navigable, or the anicut stand. What an illustration of Horace does the Government afford! standing on the Godavari banks, with hands in pocket, and staring at the passing stream in stupid apathy since 1779:—

“Rusticus expectat dum defluit amnis; at ille
Labitur et labitur in omne volubilis annum.”²

¹ A Madras newspaper.

² Pp. 299, 300, “A Letter to the Secretary of the Board of Control.”



PART II

Lady Cotton's Reminiscences

The following interesting reminiscences by my mother (Lady Cotton) of her life in the Godavari district—to the breakdown of my father's health, owing to the enormous strain on his physical powers, which incapacitated him from further active work at the time—give indications of the great anxiety which weighed upon him at so critical a period in the progress of the works and which necessitated immediate and entire rest for both body and mind.

My dear husband, having sent in his plans for the improvement of the delta of the Godavari, was appointed to the charge of that district, and took up his position, with myself and baby, in a tope (or grove) on the bank of the river, about four miles from Rajahmundry.

There tents were pitched, and a rough building erected made with palmyra posts and thatched with palmyra leaves, which formed a happy home, full of large, wide, interests, as well as the interests private to myself as wife and mother.

Except for periodical attacks of jungle fever, God was very gracious to us in respect of health,—another dear little daughter was born to us in our rough house,—a sweet babe, who was her father's delight, and whose loving looks and ways, when he came in tired from his work, were always a refreshment to him. It pleased God to take her from us after about twelvemonths, and we buried her at Rajahmundry in a little graveyard looking down upon the river.

I have said our home was on the banks of the Godavari, but I ought rather to have said beside the river bed, for



during nine months of the year, there lay before the encampment miles of dry and dazzling sand, in the centre of which ran what, in such circumstances, seemed a mere thread of water, and yet was of considerable width.

A village was near us, and the poor women coming from it were pitiful to see, as they toiled across the burning sand with naked feet—often carrying a child on one side, and a chatty, or earthen vessel, which might hold a couple of quarts, poised on their heads, it being their only supply of water for (it might be) a numerous household for the day.

It need not be said that the village and villagers were dirty in the extreme, and sickly too. The ground was dry and barren, no crops, no grass for the wretched-looking cattle during far the greater part of the year.

The thought comes now, how little begging there was, when the poverty was so great. The poor people could not at first seem to understand what the strangers had come among them to do, but they were always kindly and respectful, glad to see us and grateful for a gift, but never troublesome in any way.

When the floods came, after the rains had filled the springs and rivulets in the distant hills, there was a plentiful supply of water, a grand and noble river covered the sandy bed; and looked beautiful indeed, but all too soon it disappeared, rushing on to the sea—of little use in any way to the land or people.

In 1847-48, the projected works were begun in earnest, and the tope became an active, busy scene; about twelve officers and non-commissioned officers had been sent by Government to assist in brick-making, timber-cutting, stone-quarrying, working in iron and brass; large workshops and busy, able workers gave promise of great improvements.

Soon thirteen hundred Indian workmen were employed. At first they were afraid to engage in the new occupations, and part of the labour had to be forced, but soon the work became popular among them, and when they found kindness was shown them, no oppression allowed, and regular daily pay given, they crowded to the spot and worked



willingly and well. On Saturday, two days' pay was given, that they might have Sunday's rest, as on that day no work was allowed or done.

Every week evening, half-an-hour before closing time, the man in charge of each body of workers called the men separately by name, and gave them their day's wage in their hand, and at the hour for closing a gun was fired as the signal for every man to leave work and be free. This prevented their having to wait and lose their own time—away from their food and families, as is often the case, when so many coolies are employed together.

Men and women of different castes and from many different places being gathered together, the thought could not but occur to our missionary friends, "What an opportunity for preaching the gospel!" From several different missions workers came. The Rev. Henry Fox, C.M.S., then at Masulipatam, was one of these, and was greatly interested in the Telugu-speaking people.

Then there had been a mission conducted in the delta for several years; and Mr. Bowden, of that mission, used very frequently to visit the people.

There is little to say of fruit: one incident showed that the Word had not been spoken all in vain, and gave us hope. One of the missionaries was walking in the quarry, then a busy scene, and heard some of the workmen scoffing and taunting one of their number with belonging to Jesus Christ. Mr. Bowden asked the meaning of this, and while the man accused said nothing, the others persisted that it was true, that he was always thinking of Jesus Christ and His Word.

Mr. Bowden left the place, intending to take another opportunity of finding out more, and for that purpose went again to the quarry a day or two later. On entering it he met the man of whom he had heard these things, leaving his work, stricken with cholera, his companions still following him with taunts: "You need not be afraid to die, you'll go to Jesus Christ." He died that night, declaring himself a believer, and charging his wife to allow no heathen cere-



monies when he was gone. Who can tell how many who heard the blessed news at that time believed, and entered into life!

So the time passed on in busy, interesting work. At last we were obliged to leave our home, as the neighbourhood had become too busy and noisy to be a pleasant place of residence, and another house, rather less rough and more commodious, was built for us, on the top of a low hill, a little farther from the river. It had several advantages and one disadvantage. Our hill had been found to contain a most convenient supply of stone, and a small railway had been made to convey it to the anicut. Sometimes the blasting in the quarry sent pieces of stone rattling upon our roof or falling round us. At a certain hour a messenger from the quarry would appear, requesting, with a salaam, that "Missis" would call in the children for safety, from, it might be, a score of blastings within a hundred yards of us! Our house was cracked in many places, the light appearing through the walls.

The snakes, too, were sadly disturbed by the blasting, and found the house a piece of comparatively undisturbed ground—a place of refuge! One evening an ayah, who had been left to watch the nursery, rushed into the sitting-room to tell us she had seen a large cobra glide into the room. We all went to see, and the children were taken elsewhere, but the snake was nowhere to be found. Still, the woman persisted that she knew it was there, so we bid her watch again. Very soon after we heard her scream; my husband got his gun, called a servant with a light, and went in. My sister and I listened eagerly; for some minutes there was no sound, then one barrel of the gun was fired, and I went to see what had happened. As I entered the nursery my husband fired again, with the muzzle of the gun under a chest of drawers, behind which the serpent had hidden itself. I can never forget the sight I saw—the cobra had raised itself to its full height, its hood was spread to its widest extent, its tongue protruded, and it was hissing in its rage and pain. It was powerless to do